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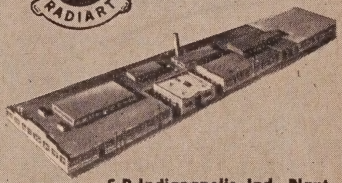
C-D Fuquay Springs Division, N. C.



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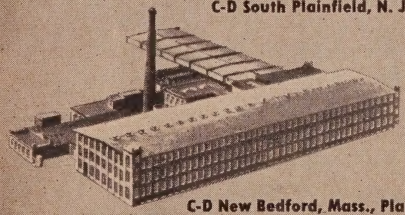

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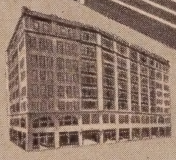

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Vol. 19 MAY, 1954 No. 5

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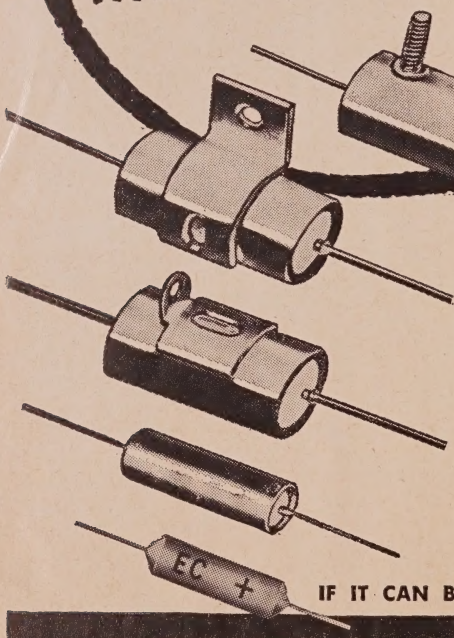

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A SIMPLE TRANSISTOR TESTER

The past two years have witnessed rapid strides in the application of transistors to practical circuits. Transistor production figures have reached impressive values for so young an electronic component. Research and development is being carried on both in military and civilian laboratories.

Such accelerated activity has created a demand for test equipment for evaluating transistors before and after they have been placed into service. Numerous such equipments of varying degrees of complexity have appeared. Some of these instruments give meter readings of various transistor parameters, while others produce an oscilloscopic display of a family of curves. In general, each of these instruments may be compared with the complex vacuum-tube bridges and characteristics plotters found only in affluent laboratories.

Some interest has been expressed in simple transistor testers, within the budget of a less well-to-do laboratory or shop, which might be constructed and used by private experimenters. This type of tester would employ no costly components, preferably would utilize a meter already available in the shop, and would require no costly auxiliary equipment for initial calibration.

The Editors have considered this problem and have concluded that a practical solution is a simple adaptor for measuring current amplification factor. This unit would permit the checking of either **alpha** or **beta**. The importance of the amplification test is based upon the consideration that most experimental applications of transistors, especially those of an educational nature, are based upon ability of the transistor to amplify. It would appear, therefore, a check of current amplification factor (somewhat analogous to measuring the amplification factor of a vacuum tube) might be the simplest single test for a transistor. It is agreed readily that the transistor, resembling as it does an active 4-terminal resistance network, has several interdependent parameters of importance and that each of these probably should be measured for a complete appraisal. However, the tube also has a number of important characteristics (for example, plate resistance, plate current, grid current, power output, voltage amplification, etc.), but a rapid determination of transconductance or amplification factor, with a relatively simple tube tester, usually furnishes an appraisal which is satisfactory for most practical purposes. This is especially true where speed is a factor or a large number of tubes must be checked.

Current Amplification Factor Defined

An enormous amount of basic transistor literature has appeared. It has ranged from simple qualitative explanations to mathematical treatises. In spite of the quantity, however, many readers have only slight acquaintance with transistor characteristics. It is for their benefit that we pause here to define the current amplification factor which the subject tester checks.

The transistor basically is a current amplifier. In fact, it appears to be the first true amplifier of current. In either of its circuit connections (common-base, common-emitter, and common-collector — also known as grounded-emitter, grounded-base, and grounded-collector), an input-current increment causes a somewhat larger increment of output current in the point-contact type. In the junction type, the output-current increment is never greater than the input-current

increment. In the common-base circuit, this means that a change in emitter current produces a larger change in collector current in the point-contact transistor, and produces the same change or somewhat less in collector current in the junction type.

In the common-base circuit, the ratio of collector-current change (di_c) to emitter-current change (di_e) is the emitter-collector current amplification factor alpha or **a**. Thus:

(1) $a = di_c/di_e$

where i_c and i_e are in milliamperes.

This short-circuit value of alpha assumes that the collector-to-base potential is supplied by a constant-voltage d. c. source and that the emitter operating bias is supplied by a constant-current d. c. source. Alpha varies with the level of static emitter bias current, being lowest at high values of i_e. Alpha is greater than 1 for good point-contact transistors and is less than 1 for P-N-P and N-P-N junction transistors (practical range among good units, 0.80 to 0.995).

In the common-emitter circuit, the ratio of collector-current change (di_c) to base-current change (di_b) is the base-to-collector current amplification factor beta or **B**. Thus:

(2) $B = di_c/di_b$

where i_b and i_c are in milliamperes.

This short-circuit value of beta assumes that the collector-to-emitter potential is supplied by a constant-voltage d. c. source and that the base operating bias is supplied by a constant-current d. c. source. Beta varies with the level of static base bias current, being least for high values of i_b. Beta always is much higher than alpha for the same transistor. For example, a junction transistor with an alpha of only 0.90 may have a beta of 9.0. This is understood readily when it is considered that **B** for the common-emitter circuit is equal to a/1-a. In high-alpha units, beta often is 30 to 40.

In the common-collector circuit, the ratio of emitter-current change (di_e) to base-current change (di_b) is the base-to-emitter current amplification factor designated beta or **B** as in the common-emitter circuit. Thus:

(3) $B = di_e/di_b$

where i_b and i_e are in milliamperes.

The short-circuit value of beta here assumes that the emitter-to-collector potential is supplied by a constant-voltage d. c. source and that the base operating bias is supplied by a constant-current d. c. source. As in the preceding example, beta varies with the level of static base bias current, being least for high values of i_b. In the common-collector circuit, beta is higher than in the common-emitter connection. This is understood when it is considered that **B** for the common-collector circuit is equal to 1/1-a. In very-high-alpha units in the common-collector connection, beta can be 200 or higher.

Measurement of a and B

Both alpha and beta are checked most satisfactorily by creating a small shift in the input bias current and observing the corresponding increment in output current. The input current usually is shifted above and below the static bias level. The constant d. c. output voltage of the transistor must correspond to manufacturer's recommended value for the selected input bias current level.

In the static measurement of current amplification factor, the input current is shifted by manual adjustment of the current level. Separate d. c. milliammeters are provided for the simultaneous indication of input and output currents, or provision is made for switching a single meter successively between input and output circuits of the transistor. For illustration, consider that the common-base circuit is operated with an emitter current i_e and collector current i_c. To check alpha statically, the emitter current is shifted first to a value i_{e1}

a small amount lower than i_e, say 0.05 ma. lower. The corresponding collector current value, i_{c1}, is recorded opposite i_{e1}. The emitter current next is shifted to a value i_{e2} the same small amount (say, 0.05 ma.) higher than i_e, and the corresponding collector current value recorded as i_{c2}. The emitter-current increment (di_e) now is $i_{e2} - i_{e1}$, and the collector-current increment (di_c) now is $i_{c2} - i_{c1}$. These numerical values finally are substituted in Equation (1) for calculation of alpha. The technique is the same for checking beta for the common-emitter and the common-collector connections, except that the base current is varied below and above its static value (i_b) and the corresponding changes noted in collector current (for the common-emitter) or emitter current (for the common-collector).

Static measurements of current amplification factor are satisfactory for many purposes. However, all practical electronic technicians are familiar with the desirability of dynamic tests in rating tube performance. The superiority of the dynamic test results from the more close resemblance of test conditions to actual operating conditions of the tube as an amplifier or oscillator. The same philosophy applies to the transistor. The dynamic test of current amplification factor not only is faster in most cases, but more closely resembles and approximates the operating conditions of the transistor in the signal circuit in which it is used.

Figure 1 shows the arrangement of a circuit for dynamically checking cur-

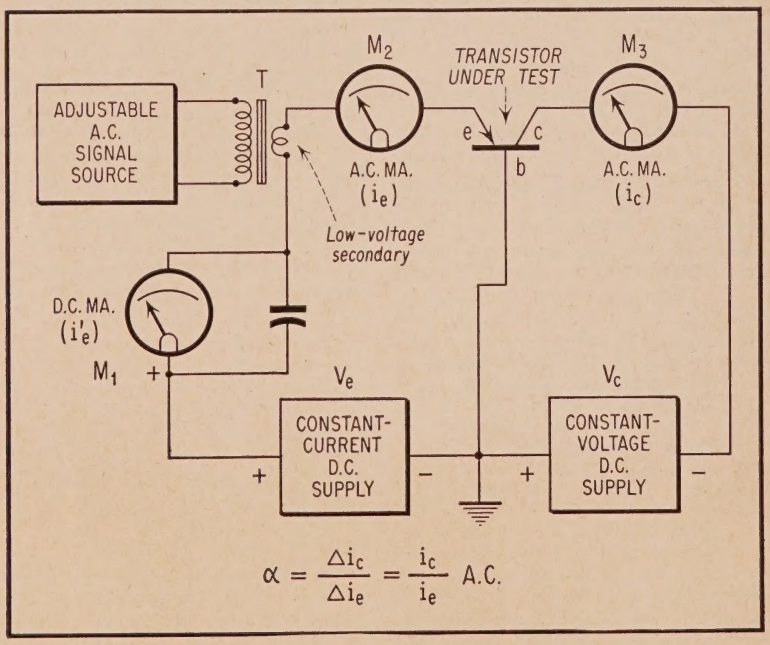


Fig. 1. Basic Principle of Dynamic Alpha Tester.

rent amplification factor alpha of a transistor in a common-base connection. Positive emitter bias, i_e', is supplied by the constant-current d. c. supply (v_e) and its level is indicated by the d. c. milliammeter, M_1. Negative collector voltage, v_c, is supplied by the constant-voltage supply. An a. c. signal current of adjustable amplitude is superimposed upon the d. c. emitter current by the secondary of transformer T and its value (i_e) is indicated by the a. c. milliammeter, M_2. This a. c. signal swings the emitter bias above and below the static value i_e' and causes a corresponding amplified alternating collector current (i_c) to flow. The latter is indicated by the output a. c. milliammeter, M_3. Here, the current amplification factor, measured dynamically, is equal to:

(4) $\alpha = i_c/i_e$

where i_c and i_e are in a. c. milliamperes.

If the a. c. emitter current, i_e, always is set to a predetermined reference value, the scale of the collector a. c. milliammeter, M_3, may be graduated to read directly in alpha units.

Beta may be checked dynamically in much the same manner, except that the transistor base is connected to milliammeter M_2, the emitter grounded, and constant-current supply v_e and d. c. milliammeter M_1 reversed in polarity. The a. c. signal input now must be considerably lower in amplitude, since the current amplification is much higher than alpha. The input current, indicated by M_2, now is the base current i_b, and beta for the common-emitter circuit is:

(5) $\beta = i_c/i_b$

where i_b and i_c are in a. c. milliamperes.

To check beta dynamically for the common-collector connection, the transistor base is connected to milliammeter M_2, the collector grounded, the emitter connected to milliammeter M_3, d. c. supply v_e connected with + to the positive terminal of meter M_1 (as shown in Figure 1), and d. c. supply v_c connected with + to meter M_3. As in the common-emitter circuit, the a. c. input-signal amplitude is kept low, because of the high current amplification provided by this circuit. Meter M_2 now indicates the base current (i_b), meter M_3 shows emitter output current, and:

(6) $\beta = i_e/i_b$

where i_b and i_e are in a. c. milliamperes.

In each of the foregoing descriptions (and in Figure 1), d. c. supply polarities are correct for N-type point-contact and P-N-P junction transistors. Each of the supply polarities (v_e and v_c) must be reversed, in each instance, when checking P-type point-contact and N-P-N junction transistors.

Constructional Details of Tester

Figure 2 shows the circuit of the transistor tester based upon the principles discussed in the foregoing sections. This circuit checks dynamically, current amplification factors α and β with the aid of an external a. c. vacuum-tube voltmeter-millivoltmeter. Direct-current bias is supplied by two external sources which can be batteries or a. c.-operated power units. The circuit is simplified by use of the external meters and d. c. sources which then need not be tied up beyond the limit of the transistor tests.

The circuit is seen to be similar to the basic setup in Figure 1. The transistor under test is connected to the three terminals E, B, and C. These terminals are labeled correctly for measurement of alpha for the common-base connection. For common-emitter and common-collector connections, the transistor leads are shifted, as will be explained under **Operation.**

The large series resistor, R_1, gives constant current characteristics to the 100-volt supply, v_e. It is essential that this supply be well-filtered, since ripple can appear as an amplified

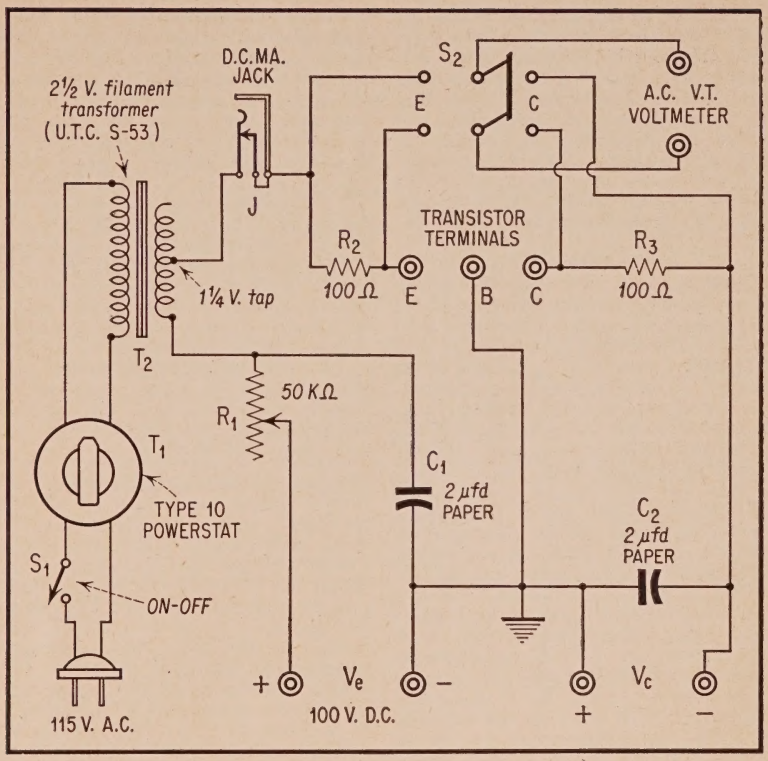


Fig. 2. Complete Circuit of the Transistor Tester.

signal in the transistor output. A d. c. milliammeter (0-10 ma. for common-base, and 0-1 ma. for common-emitter and common-collector connections of the transistor) is plugged into jack J to set the transistor input bias to the desired measurement level. The input bias level is set by means of adjustment of voltage v_e, together with R_1.

A 60-cycle test signal is supplied by the secondary of transformer T_2 and is continuously adjustable by means of the Powerstat, T_1.

The a. c. signal-current level is read on the scale of the external a. c. vacuum-tube voltmeter-millivoltmeter, with switch S_2 in position E for the input current and in position C for the output current. The deflection results from a. c. voltage drop produced by the currents flowing through the identical 100-ohm resistors, R_2 and R_3. Suitable voltmeters for this application are Hewlett-Packard 400C, Heathkit AV-2, and similar instruments which read as low as 10 millivolts r. m. s. full-scale.

In operation, the transistor is supplied with its normal d. c. biases. Rheostat R_1 is adjusted for desired input bias (See transistor manufacturer's characteristics sheet). Switch S_1

is thrown to its position E and the Powerstat adjusted for a reference deflection of the v. t. voltmeter. The corresponding input current is recorded as the a. c. input current. Switching S_2 to its position C then produces a voltmeter deflection proportional to the output current. The current amplification factor is the ratio of the output current to the input current. Detailed operating instructions follow.

Operation

Common - Base. (1) Set T_1 to its lowest-voltage point. (2) Set R_1 to its highest resistance. (3) Plug a 0-10 d. c. milliammeter into jack J. (4) Connect a 100-volt, low-ripple d. c. supply to terminals v_e. (5) Connect the rated transistor d. c. collector voltage to terminals v_c. (6) Connect the transistor emitter, base, and collector leads to terminals E, B, and C respectively. (7) Vary voltage v_e and adjust R_1 carefully until the d. c. milliammeter reads the emitter current level chosen for the alpha measurement. (8) Insert the line plug into a 115-volt a. c. outlet. (9) Connect the v. t. voltmeter and set it to its 0-10 millivolt range. (10) Throw switch S_2 to its E position. (11) Close switch S_1 and increase the setting of T_1 to give a voltmeter reading of 5 millivolts. This voltage drop across the 100-ohm resistor, R_2, corresponds to an i_e signal current of 50 microamperes. (12) Switch S_2 to its position C, and note the voltmeter reading (E). The output a. c. collector current, i_c, flowing in the 100-ohm resistor R_3 then is E/100 or 0.01E. (13) Calculate the current amplification factor alpha from the relationship $\mathbf{a} = 0.01E/i_e$.

Common - Emitter. (1) Set T_1 to its lowest-voltage point. (2) Set R_1 to its highest resistance. (3) Plug a 0-1 d. c. milliammeter into jack J. (4) Connect a 100-volt low-ripple d. c. supply to terminals v_e **but with polarity opposite that shown in Figure 2.** (5) Connect the rated transistor d. c. collector voltage to terminals v_c. (6) Connect the transistor base to terminal E, emitter to terminal B, and collector to terminal C. (7) Vary voltage v_e and adjust R_1 carefully until the d. c. milliammeter reads the base-current level at which the beta measurement is to be made. (8) Insert the line plug into a 115-volt outlet. (9) Connect the v. t. voltmeter and set it to its 0-10 millivolt range. (10) Throw switch S_2 to its E position. (11) Close switch S_1 and increase the setting of T_1 to give a voltmeter reading of 5 millivolts. This voltage drop across the 100-ohm resistor, R_2, corresponds to an i_b signal current of 50 microamperes. (12) Switch S_2 to its position C, and note the voltmeter reading (E). The output a. c. collector current, i_c, flowing in the 100-ohm resistor, R_3, then is E/100 or 0.01E. (13) Calculate the current amplification factor beta from the relationship $\mathbf{B} = 0.01E/i_b$.

Common - Collector. Set T_1 to its lowest-voltage point. (2) Set R_1 to its highest resistance. (3) Plug a 0-1 d. c. milliammeter into jack J. (4) Connect a 100-volt, low-ripple d. c. supply to terminals v_e in the same polarity shown in Figure 2. (5) Connect the rated transistor d. c. collector voltage to terminals v_c **but in polarity opposite that shown in Figure 2.** (6) Connect the transistor base to terminal E, collector to terminal B, and emitter to terminal C. (7) Vary voltage v_e and adjust R_1 carefully until the d. c. milliammeter reads the base-current level at which the beta measurement is to be made. (8) Insert the line plug into a 115-volt outlet. (9) Connect the v. t. voltmeter and set it to its 0-10 millivolt range. (10) Throw switch S_2 to its E position. (11) Close switch S_1 and increase the setting of T_1 to give a voltmeter reading of 5 millivolts. This voltage drop across the 100-ohm resistor, R_2, corresponds to an i_b signal current of 50 microamperes. (12) Switch S_2 to its position C, and note the voltmeter reading (E). The output a. c. emitter current, i_e, flowing in the 100-ohm resistor, R_3, then is E/100 or 0.01E. (13) Calculate the current amplification factor beta from the relationship $\mathbf{B} = 0.01E/i_b$.

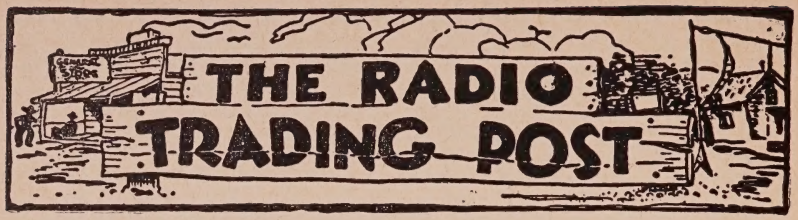
CAUTION: The d. c. supply (v_e and v_c) polarities shown in Figure 2 or described in the foregoing operating instructions are correct only for N-type point-contact transistors and P-N-P junction transistors. When testing P-type point-contact transistors or N-P-N junction transistors, reverse the polarity of each supply. This caution applies to each of the three connections — common-base, common-emitter, and common-collector. Be sure you have the correct polarity before closing any switches.

Observe this caution and follow the operating instructions carefully and in the order of steps given, or the transistor may be damaged. Disconnect all voltages before removing the transistor from the test circuit.

Table of Values

The accompanying Table lists alpha current amplification values for commercial transistors. Consult the transistor manufacturer's recent data for correct emitter d. c. bias current and collector d. c. bias voltage.

MANUFACTURER	TYPE	CURR. AMP.
CBS-Hytron	PT-2A	1.5
	PT-2S	2.0
General Electric	G-11	2.2
	G-11A	2.5
	2N43	0.955
	2N44	0.92
	2N45	0.92
Hydro-Aire	A-0	3.0
	A-1	2.0
	A-2	2.0
	A-3	2.0
National Union	T18B	1.7
	2N39	0.94
	2N40	0.90
	2N42	0.85
Radio Receptor	R1729	2.5
Raytheon	CK716	1.5
	CK721	0.975
	CK722	0.90
RCA	2N34	0.98
	2N35	0.98
Texas Instrument	200	0.90
	201	0.95
Transistor Products	2C	2.0
	2F	2.0
	2G	2.0
	X-22	0.90
	X-23	0.95
Westinghouse	WX-3347	2.0



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SWAP — Delco auto radio and Kodak tourist camera with flash unit for vacuum tube voltmeter, tube checker, sweep gen., or what have you? A. J. Kinge, 1029 - 73rd St., Brooklyn 28, N. Y.

FOR SALE — 75 w. Webster booster amplifier. 11 tubes-fixed bias-pre-amp. built-in. Excellent tone, A-1 cond., in gray crackle finish steel cabinet, $55 FOB. M. A. Porter, 1709 N. Larrabee St., Chicago 14, Ill.

TRADE — PE101 dynamotor, converted to 6 or 12 v., for pair of 805 tubes. A. G. Ferris, 1768 Fruitdale Ave., Indianapolis 21, Ind.

FOR SALE — Farnsworth AM-FM radio with speaker, no cabinet, needs alignment, $30; Philips radio receiver 390AN, AM-SW, 5 bands, $30. Max Schloss, 34-24 82 St., Jackson Heights 72, N. Y.

FOR SALE — Swivel-Top table for TV, 19¾ x 20", $15; electric radiator heater with handle, five sections, no water, $19. Paragon Radio Service, 170 - 26 Jamaica Ave., Jamaica 3, N. Y.

FOR SALE — TV booster, needs work, $5; back issues radio magazines; crystal radios, $1; 6 pc. ratchet screwdriver set, $2; 8 w. utility recording amp., $10. Walter J. Smith, Box 26, Charlotte, Mich.

FOR SALE — Two BC-375E Xmtrs. complete with tuning units, antenna couplers and dynamotors; Motorola T19-23 ten meter Xmtr less power Xformer; BC-645A transceiver. Best offer. R. W. Drobish, 1244 Irving Ave., Berkeley, Ill.

WANTED — Sams Index Nos. 25 and 26; back issues of Radio-Electronics, Radio and TV News; Service, other radio and TV magazines. State cond., and price. Edward J. Kimmel, 1807 Hartman Ave., Louisville 5, Ky.

WANTED — Tube checker, any cond., must be low cost. G. R. Burns, Jr., 1000 Ridge Ave., Ben Avon Heights, Pittsburgh 2, Pa.

WANT JOB — In television or broadcasting station. Have first class radio telephone license. Inexperienced. John Brennan, 129-36 135 Place, South Ozone Park 20, N. Y.

FOR SALE — BC-454-B 3-6 Mc. receiver, $15; SCR 522 2-meter receiver and Xmitter (receiver converted), $25; both with diagrams and conversion data; Pilotuner FM tuner, $8. Seymour Tenzer, 138 Dahill Rd., Brooklyn 18, N. Y.

WANTED — FM receiver to cover 152-174 Mc., reasonable, and tube tester or set tester. State details and price. Don Vickers, 12 Ashland Ave., Baldwin, N. Y.

SELL OR SWAP — Hickok 610 sweep gen., Eico 425 scope, Simpson 260 VOM, Triplett 630-A VOM. Want Hickok 538 tube tester, 19X sig. gen., RCA WO56C scope. M. Meyers, 2329 Washington Blvd., Venice 68, Calif.

SELL OR TRADE — Radios for '47 Chevy, '41 Pontiac, Eico 360 sweep gen., 325 scope without case, VTVM Capacitor, all A-1 cond. Want '49 Studebaker auto radio. Joseph Niedzielski, 558 Ralph Ave., Brooklyn, N. Y.

SELL OR TRADE — NRI model 112 R-C bridge $30; NRI S.G. model 88, $30; Clark 25 w. amp., $35. Want Triplett 630, Simpson 260, Electro BJ, Mallory 6SR10, or NRI tube tester. Paul Bateman, 625 Sunnyslope, Emporia, Kan.

FOR SALE — Carter dynamotor 350 v., 150 Ma., Cont. duty; GE model 250 self-charging portable radio; Argus C3 camera with leather case; complete two-station intercom Command transmitter. Want reflex camera 2¼ x 3¼ or similar. Clyde Keeler, 66 Franklin St., Port Jervis, N. Y.

WANTED — Scott Philharmonic FM-AM 33-tube chassis complete with audio chassis and speaker's network with tweeters. Also tuner chassis, audio chassis, and speaker's network for same radio. Cash or trade. Woodie's Fixit Shop, 1709 E. Stella, Fort Worth 4, Tex.

TRADE — 21" CBS Columbia TV cabinet in exc. cond.; .22 single shot rifle, l. n. Want radio tube tester in good cond. Donald Harrington, Sugar Grove, Va.

FOR SALE — Riders Manuals 1 thru 5 abridged, 6 thru 16 (12 vols.), and Riders TV manuals 1 thru 3. Will ship express prepaid. P. E. Marangello, 12108 N.E. Fifth Ave., No. Miami, Fla.

FOR SALE — BC-221 AH Freq. meter, good mechanical cond. with orig. calibration book, less crystal. Needs aligning, $35. M. Garey, 1601 Pedley Dr., Alhambra, Calif.

FOR SALE — Sams 1 - 110 complete in binders, exc. cond., $50. Will ship on receipt of $15, balance express collect COD. A. Hochheimer, 446 Willow Ave., Scotch Plains, N. J.

WANTED — Power supplies; 2000 to 2500 DC at 500 mils; 1500 to 2000 DC at 400 mils. Complete modulator at 500 w. audio and 500 w. modulation transformer. Ken Anderson, Kerkhoven, Minn.

FOR SALE — DeVry 16 mm. sound projector, 2 case unit 25 w. amplifier, 10" speaker, 750 w. lamp, 1600 ft. film capacity, exc. cond., $75 or best offer. Shipped COD. P. Lazzio, Lake Geneva, Wis.

FOR SALE — Radio Television Technician's Course; 63 lessons, A-1 cond., 1947 issue by Radio Television Institute, Inc., $19.75. D. E. Greathouse, 1920 'S' St. NW, Washington 9, D. C.

FOR SALE — Patterson PR16 Comm. rcvr., with speaker and 2 sets of l. n. tubes. Will ship. Leo Joe Blumle, 116 W. Fourth St., Emporium, Pa.

WANTED — Crosley 12" plastic table model TV in trade for Solar condenser checker. Toups Radio Service, 317 W. Pine St., Crowley, La.

FOR SALE — Radio and TV repair and sales business in the heart of the Lakes Region! Must sell for health reasons. Good profit making business. Rental $10 a month. All for $5,000. Aurzada Radio Service, Wadena, Minn.

SELL OR TRADE — Philco 48-1000 TV set; Riders 1 thru 16 complete; Triplett 1200 VOM; 3600 v. AC CT at 1800 at 500 mil.; 7" National TV set. Want Beam equip. Prefer local trade 500 miles from Charlotte limit. J. B. Smith, 505 Woodlawn St., Belmont, N. C.

FOR SALE — Hanovia S-319A medical sun lamp, l. n.; Zenith TV console, 16" aluminized tube, doors; Crosley AM-FM-phono, 5-band console 148CP, A-1 cond.; IRE, Electronics. A. Newton, 105-20 65th Ave., Forest Hills 75, L. I., N. Y.

TRADE — Allstate air compressor 17 gal. size, 2 paint spray guns, for PA system 25 w. or higher, 110 v. AC and 6 v. DC with speakers and mike. DeWitt Monroe, Tar Heel, N. C.

FOR SALE — NRI course, less kits, $15 plus postage. Samuel L. Braucher, 42 Carlton St., Sodus, N. Y.

FOR SALE — Hickok 156 Traceometer, good cond., complete with instructions, $125 FOB. Fred Hoefner, Hooper, Neb.

SELL OR SWAP — Millen grid dip meter, l. n.; Sams Photofacts, 1-207 incl., A-1 cond. Want cash, typewriter, tape recorder. Voyd R. Jones, 336 Hypathia Ave., Dayton 4, Ohio.

TRADE — Radio books and magazines, for nature books and also Americana and historical books of the West only. Send for list. Walter Fry, Box 753, Caldwell, Idaho.

FOR SALE — Precision sweep gen. E-400, l. n., $90; 18 vols. Riders Troubleshooter Guides, l. n., $80. H. Gathercole, 45 Aberdeen Drive, Huntington, L. I., N. Y.

FOR SALE — Riders Manuals 1 thru 17, A-1 cond., $85; Vibroplex original and case, l. n., $12; Webcor model 288 professional wire recorder, exc., $100; all FOB. Jim McCoy, Box 41, Whitehall, Mont.

FOR SALE — Complete AM-FM TV alignment setup; Precision E-200C, E-400, ES-500, $150. S. F. Hepp, 83 Brendel Ave., Hamburg, N. Y.

SELL OR SWAP — BC-453 (Q-5'r), BC-696, BC-454, SCR-522, BC-625 (2 meter receiver). Want "Match Box," tape recorder. Paul Atwell, 535 Capistrano, Toledo 12, Ohio.

FOR SALE — Good radio-TV business in territory just opened to TV last June. Write for full information. J. H. M. Awrey, Hitterdal, Minn.

FOR SALE — DeForest training 2" scope complete with all tubes, $30; DeForest sig. gen. $15. Both for $43. Gene Augustine, Fenton, La.

FOR SALE — Riders radio manuals, 1 to 14 incl.; Riders record changers and recorders and Riders Vol 2. TV manual. All for $45 FOB. Holland Radio, 166 Ravine St., East Liverpool, Ohio.

FOR SALE — RCP sig. gen., $25 FOB; NRI radio servicing course, 66 lessons complete, $10; movie camera, projector; Jap 120 camera f3.5 lens, case. Details upon request. G. W. Thibodeau, 31 Elm St., Fort Kent, Me.

FOR SALE OR TRADE — Precision high voltage probe, model TV-2; Amprobe AC volt and ammeter, model A6; Oak Ridge synchro-sweep, model 104. William H. Martin, Fife Road, RD 2, Bridgeville, Pa.

SELL OR SWAP — Heath batt. eliminator and charger, $24; Eico sig. gen., 315, factory calibrated, $40; Sunray Enlarger model D with filter-condenser and foot switch, l. n., $60. Want TV test equip. Harry Ruman, 120 - 51 232 St., Cambria Heights 11, L. I., N. Y.

WANTED — NRI Service manuals vol. 1 and/or 2. George M. Krause, 321 Walnut St., Roselle, N. J.

FOR SALE — S-40 receiver, $65; PRS-1 mine detector, $35; General Industries recorder-photo assembly, $20; BC-459 transmitter, $15; Astatic type T-3 mike with Atlas desk stand and dust cover, $10; PE - 101C dynamotor, $3.50. A. Kujampaa, 29 Pine St., Bedford, Mass.

FOR SALE — 10 coin-operated radios with night-stand tables attached, all in good cond. Best offer over $300; Heathkit BG-1 bar gen., completely assembled, l. n., $15. J. O. Turner, Box 37, Homer, La.

FOR SALE — Hallicrafters S40 receiver, good cond., $45 FOB. Jerry Dewey, 329 Grand St., Allegan, Mich.

FOR SALE OR TRADE — 3AP1 cathode ray tube. Also complete nine-vol. set of Aeronautics published by National Aeronautic Council, Inc. Stanley Walter, 647 - 99th St., Niagara Falls, N. Y.

WANTED — Hallicrafter SX28 with or without speaker. Have BC-348R converted S. meter separate RF and AF control noise silencer 6AK5 first RF. Also model ECI Echophone Comm. Make offer. Local preferred. James Blair, 4323 Bronx Blvd., Bronx 66, N. Y.

FOR SALE — BC-458, 459, 696, ARC-5 unconverted and complete Command transmitters, single and double racks for same; Command receivers; BC-1206 (Q-5'r) less tubes; TU-69 RF tuning unit with three 815 tubes. A. A. Polityka, 248 Western Ave., Allegan, Mich.

SWAP — S-40A Hallicrafter comm. rcvr., for Hi-Fi equip or high power rifle. L. W. Wilson, 208 Linwood Ave., East Point, Ga.

FOR SALE — Precision 912 tube tester, $25; Vocatron CC-2 wireless intercom, $38; RCA WV65A battery volt ohmyst, $25; I.F.D. 4 set TV coupler-preamp, model 4ECA, $15. Jack A. Johnson, Box 56, Delton, Mich.

SELL OR TRADE — Ham and service parts, tubes, condensers, transformers, resistors, Xtals, sockets, fuses and holders, old radios. Also 100 copies QST 1924 to 1940. Want UHF converter, 110 v. AC generator, 6 v. DC to 110 v. AC converter. E. Carter, 814 Craig St., Schnectady, N. Y.

FOR SALE — Hammarlund HQ-129X rcvr., complete with Jensen speaker, gray crackle finish, exc. cond., $125. Herman Bartlett, 92 Birch Ave., Little Silver, N. J.

FOR SALE — Hickok 156 traceometer, $90; 500VA Adjust-A-Volt, $20; Sams Photofacts, 12 vols., $125; Riders, vols. 7, 12, 13, $24. Frank Pyle, 104 Constitution Circle, Clairton, Pa.

WANTED — Tube tester, sig. gen., condenser checker. State make, model, cond., and price of each. M. Guthait, 1360 Teller Ave., Bronx 56, N. Y.

FOR SALE — Brush PL-20 pickup, No. 3761B equalizer and spare PL-2Z cartridge, $8; Astatic X-26 crystal cutter, l. n., $4; Shure 8-ohm magnetic cutter, l. n., $3. Thos. Crane, 31 Haven Rd., South Portland, Me.

FOR SALE — National Co high fidelity 10 w. phonograph amp.; Webster 55 record changer; AM tuner T.R.F. 4 tuned stages; FM Pilotuner T-601; 12" Stromberg speaker 25 w. in cabinet. Best cash for complete set-up. Roger Shaw, Box 802, New Bedford, Mass.

WANTED — Workshop 3-element TV antennas, models A-4, A-7, A-10, and A-11. State price. All letters answered. R. West, Box 309, Dennisport, Mass.

WANTED — Complete set of Sams. Russell J. Gustafson, Route 1, Box 270, Weed, Calif.

FOR SALE — NRI comm. course complete less mike, $50; Sprague "Quikcheck" Capacitor tester, $30; T04 Telomike, $65; Superior CA-12 sig. tracer, $10. All FOB. S. Plauski, 425 - 3rd St., Brooklyn 15, N. Y.

WANTED — Sams Photofacts, radio-TV-record player; service manuals. State price and cond., Carl Higgins, 105 Grace Blvd., Coffeyville, Kan.

SELL OR TRADE — Irving 16 mm. movie camera $45 or trade for ham gear, test equip., or 35 mm. camera with f3.5 or better lens. Also 7" TV (T-54), $40 or what have you? Stanley Horton, East Branch, N. Y.

TRADE — 5 HP Johnson outboard motor, exc. cond., on radio-TV parts or test equip. in good cond., or will sell. O. K. TV Sales and Service, 363 George Orr Rd., El Paso, Tex.

TRADE — WRL Globe Trotter Xmitter in good cond. Desire shotgun or .218 Bee rifle. Metropolitan area only. Tom Trent, 787 Elsmere Place, Bronx 60, N. Y.

FOR SALE — Eico model 400 scope, $30; Alliance Tenna scope TV booster, model AB 5, $20; Meissner model 8C FM tuner, $30. All in exc. cond. Cornelius Radio Service, Rt. 2, Lancing, Tenn.

SELL OR SWAP — Pair BC-645A transmitter rcvrs., less power supply; 10 w. HiFi audio amp. with two 12" P.M. speakers; Argus K2 f4.5 lens camera; model airplane supplies, several good used motors. Want ham gear. D. E. Jerome, Box 234, Temple, Ga.

FOR SALE — Jerrold MC-1 power supply units and channel amp. strips for community and master antenna systems for channels 2, 4, 5, 7, 9, 11, guaranteed good working cond. at much below cost. Daniel Trivers, 2680 Old Town Rd., Bridgeport, Conn.

SELL OR TRADE — Radio and TV study books worth $100; up to date popular transmitting and receiving tubes, good radio parts, Ithica Pump shotgun, Argoflex camera, for cash or Hi-Fi equip. Bernard Loebe, WEHT-Television, Henderson, Ky.

SELL OR TRADE — Radio, TV, and ballast tubes; Zenith TV remote control motor assembly, $6; good 7" and 8" pix tubes. Will exchange trade lists. Andrews, 740 Maple St., Bethlehem, Pa.

FOR SALE — Vibrator converter, model 11 ORT 35, input 110 v. DC, output 110 v. AC, watts cont. 350, watts int. 500; Repl. vib. 3079, serial No. 1220, exc. cond., $50. S. Chas. Lerner, 410 Riverside Dr., N. Y., N. Y.

SELLING OUT — Radio, electronic parts, Heath test equip., Triplett meters, text and handbooks. Sacrifice. List available. P. M. Ohlinger, Portsmouth, Iowa.

WANTED — Surplus transmitter, receiver, test equip., or radio altimeter. Will swap resistors and condensers, and make up difference by cash. S. S. Brody, 1814 E. 16 St., Brooklyn 29, N. Y.

FOR SALE — Craftsmen C10 tuner, $75; RC2 amp., $25; Motorola 5A7-A portable, $20; 6 x 9 cm Voightlander with f4.5 Tessar, $15; K & E Minusa drafting set, $15. Norman Tetenman, 2350 East 27th St., Brooklyn 29, N. Y.

WANTED — Old rockcrusher Xmitting gap of the quenched type. Capacity, 0 to 2 inches or more. Telford's Radio Service, 147 Lewis St., Minersville, Pa.

POSITION WANTED — By Electronics Technician with radio, UHF and VHF, television, communications and mobile equip., and radar servicing experience. Can also service other electrical appliances or equipment. All offers given full consideration. W. R. Whitcomb, Albany, Wis.

FOR SALE — Eico sig. gen. ,model 322-K, factory wired, never used, $25. Benjamin C. Schaffer, 761 St. John St., Allentown, Pa.

SALE OR TRADE — Supreme push button set tester model 592; trade for 16 mm. sound projector and films. Frank Siegel, 107 Rodney St., Brooklyn 11, N. Y.

WANTED — Complete radios 1927 or older, any make, need not play. Also 3" or 5" TV set. Old automobile lamps and horns, motometers, etc. Have used radio tubes, cash. Harold Garrett, 711 South N. Y., Sedalia, Mo.

FOR SALE — Electronics magazine, Aug., Sept., Oct., Dec., 1945, and 1946-1952 complete except Sept. '48. Make offer for the lot. All in good cond. Curtis Radio, Enterprise, Ore.

FOR SALE — 6" DC voltmeter 0-25 v., round Swbd. type, $2; 6" DC ammeter 0 to 30 and 0 to 600 amps., no shunt, $2; 4" Westinghouse AC ammeter, with current trans. 0 to 150 amps., $4. Stephen Stewart, Rt. 2, Box 343, Power Plant 2, Saugus, Calif.

WANTED — Disc - recorder (non-professional) or turntable with crystal cutter in good working order. Erich Rachner, 67 Montgomery Ave., Irvington 11, N. J.

FOR SALE — 1954 comm. receiver, $29 FOB; AR-2 Heathkit, in factory cabinet, all assembled, bandspread, BFO, RF gain, noise limiter, standby switch, phone jack, 5½" speaker, 535 Kc. to 35 Mc., transformer operated, manual included. Rene's Radio Shop, 795 North Tenth Ave., Kankakee, Ill.

WANTED — Impedance and Inductance Bridge. State model, price, make, and cond., must be reasonable. Will consider Heathkit. Also want Radio Engineering Handbook, Terman, prefer 2nd hand. R. Chlupsa, 45 - 56 189th St., Flushing 58, N. Y.

WANTED — McMurdo Silver Masterpiece V, Scott-Quaranta, Hammarlund, Super-Pro, RCA Berkshire receiver. Geo. A. Cahill, East Dennis, Mass.

WANTED — Collins 310B or 310C exciter, 75A-1, 32V-1 or 32V-2; No. 15 Teletype Printer, AR-88-D RCA receiver. F. Minturn, Box 252, Boston 1, Mass.

FOR SALE — Bar generator, Heathkit model BG-1, exc. cond., $10. Joseph F. Dineen, 9 Winter Terr., Westwood, Mass.

SWAP OR SELL — Weston model 594 photronic cell, 1. n., back issues of AIEE and Radio News. Want U. S. stamp collection, plate blocks, or what have you? M. Crabb, 304 Kimble Rd., Vestal, N. Y.

FOR SALE — 1950 Radio and Television News, complete, also 1951, '52, '53, and Radio Electronics magazines from Feb. 1950, incomplete; Everybody's Radio Manual by Popular Science, $1.75; TV Service Cyclopedia by Coyne, $4, etc. Write for complete list. Daniel Seidler, 4825 S. Wolcott, Chicago 9, Ill.

FOR SALE — RCP 461 20,000 ohms per volt multimeter, oak case, meter movement coil open, otherwise perfect, $8; Hickok 550X tube and set tester, $40; Westinghouse O-300 Ma. 2" panel meter, $3. F. Maher, 2548 Fernwood Ave., Roslyn, Pa.

SWAP — Eico push-pull 7" factory-built scope, used less than 5 hours, for Precision E-400 sweep gen., or RCA TV calibrator WR-39C, or Sams Photofacts. Robert Q. Childress, 125 West Fifth St., Cookeville, Tenn.

BUY OR SWAP — For standard equip., all types government surplus tubes, components equip., especially want BC-312, 342, 1000, 1306, AN/ARC-1, AN/ARC-3, AN/ART-13, RTA-1B, R-5/ARN-7, R-89/ARN-5, selsyns, synchros, servo motors, amplidynes. Lectronic Research, 715 Arch St., Philadelphia 6, Pa.

FOR SALE — Portable brush tape recorder BK 414, $60; Meissner Ex-Signal shifter with extra 160 meter strip, $40; St. 203A transmitter, $20. Edward B. Schofield, 9031 Ft. Hamilton Parkway, Brooklyn 9, N. Y.

SELL OR SWAP — RME DB22A Pre-Selector, $35; Millen R-9'er, $15. Want 1250-1500 v. @ 500 Ma. plate transformer. Frank W. Jones, Gabbs, Nev.

SWAP — Model 6S Briggs and Stratton engine; Riders vols. 11 to 14, 16; Westinghouse watt hour meter 240 v. 15 amps., type CA; Supreme model 400 tube and set tester, for ham gear or what have you? D. C. Dough, Aurora, N. C.

SELL OR TRADE — 30 w. Bogan amp., 110 v. AC or 6 v. DC, complete with turntable, trumpets, drivers, mike, and connecting cords. Want ham gear, late TV set, Riders manuals, or cash. Frank Henrikson, 1615 S.E. Alexander St., Pendleton, Ore.

FOR SALE — Riders radio manuals, 1 thru 14 and 16, all in good cond., except vol. 1, which is fair, $60. Fred Hartshorn, 4146 - 41 Avenue South, Minneapolis, Minn.

FOR SALE — Vomax VTVM 900 in perf. cond., 1st $45 takes it. W. H. Weiss, 1009 E. Riverside Ave., Merrill, Wis.

SELLING OUT — Hallicrafters S-40-A rcvr.; two transmitters, one with new 813 final; 14 Xtals with holders; panel meters; low-high power tubes and packs; modulation equip, etc. $400 value, first $100 takes. Joe Ziegelheim, 16304 Telfair Ave., Cleveland, Ohio.

FOR SALE — Custom-made National 16" TV sets, mahogany veneer console cabinets, in orig. factory cartons, $175 FOB. L. O. Terry, 15 Riggs Road NE, Washington 11, D. C.

FOR SALE — Mallory 6 v. power supply and battery charger model 6RS10, $25, RCA model WV-77A Jr. voltohmyst, $40. Howard C. Jones, 52 N. Quentin Ave., Dayton 3, Ohio.

WANTED — BC-611 Handi-Talkies on freq. 5338 Kc. or 3330 Kc.; schematic and other technical manuals on repair and operation of War Model Handi-Talkies. S. E. Tima, 2833 N. Greenfield Road, Phoenix, Ariz.

FOR SALE — Used Riders (radio) vols. 1, 2, 4, 7, 9, 10, 12-19, 22, $3 each, 1. n. vols. 1-5 abridged, 7-11, 13, 17, $5 each, 1. n. Sams 1, 2, 5-13 in DeLuxe binders, $5 each. H. O. Berman Co., Inc., 12 E. Lombard St., Baltimore 2, Md.

FOR SALE — 630-TS Fada model 940 12½" TV receiver using standard coil tuner, console cabinet, receiver in exc. cond., $125 FOB. R. T. Courtney, 627 Oakwood Ave., Lancaster, Ohio.

SELL OR TRADE — SCR-284A and accessories for TV set in good working cond., or $30, transportation collect. Milo G. Burston, 320 Tawas St., Alpena, Mich.

FOR SALE — Triplett tube checker, 1940 vintage, reasonably good cond., $10 or best offer. Will ship. Chief Engineer, Station WCHV, Charlottesville, Va.

WANTED — Will pay $1 for instructions and schematic, with values, for McMurdo Silver "Sparx" model 905A sig. tracer and Universal speaker. Write first. B. Cohen, 3042 Br. 6th St., Brooklyn 35, N. Y.

TRADE — All Eico: sweep gen., scope, sig. gen., VTVM, resistance-cap.-bridge; Philco Circuit Master VTVM. Want tape recorder, electric trains, TV set or ?? DeCoberts Radio and TV Service, 609 Henrietta St., Gillespie, Ill.

FOR SALE — Riders manuals 1-5 abridged, 6 thru 11, reasonable. Send for list of other technical books. Samuel A. Gornick, 1150 N. LaSalle St., Chicago 10, Ill.

SELL OR SWAP — Hallicrafter S20R receiver with pre-selector and 'S' meter, Philco 027 tester, wire recorder, early Edison phonograph with 70 records, for Viking II or Collins 32V3 or camera. N. Bell, 185 Vreeland Ave., Nutley, N. J.

FOR SALE — One each, 5-element Channel 4 Yagi; 8-element Channel 5 Yagi. Best offer. R. C. Nicholson, RD 2, Brinkley, Ark.

WILL TRADE — Dunlap 6" swing, 18" between centers metal turning and 8 to 96 threads per inch lathe, 1. n.; for 5" or 7" late popular make scope. McKinley's Radio and TV Service, Zebulon, Ga.

WANTED — Complete radio-TV courses with or without kits. State price, cond. and list of materials furnished. Thomas A. Barni, 5331 Pattison Ave., St. Louis 10, Mo.

FOR SALE — Eico 221 VTVM and Heathkit sig. tracer, both in good cond. Make offer for either or both. Paul B. Harris, 112 Wellington Hill St., Mattapan 26, Mass.

FOR SALE — Four perfect 40 meter SW3 coils; perfect Electron Oscillograph and sweep circuit; General Radio, model 687A. Charlie's Radio Service, 81 Warren St., Roxbury 19, Mass.

FOR SALE — NRI radio and TV comm. correspondence course, without kits, complete with 78 lessons and 5 reference books, $25. Don Ketchum, 1114 Diamond Ave., South Pasadena, Calif.

WANTED — Wiring diagram with voltage readings for Tom-Thumb Personal automatic radio, model E3INIA. R. F. Meates, 3270 Waterbury Ave., New York 61, N. Y.

FOR SALE — Precision tube tester, model 612, exc. cond., $50; Heath scope, model 05, exc. cond. with extra CR tube, $30; SCR 522 VHF transmitter-receiver, l. n., $50. J. W. Zach, 27 Day Avenue, Northampton, Mass.

SELL — Hammarlund HQ 120X receiver, completely overhauled, with speaker, $75; Craftsman 220 v. AC 160 amp. electric welder, complete with helmet, $90. G. Gnandt, Wellington, Ohio.

SWAP — Federal Enlarger, model 269, cold light, for electronic gear, transmitter or what have you? Roland Slatkoff, 3834 Southern Cross Dr., Baltimore 7, Md.

SELL OR TRADE — Model 900 Vomax VTVM, Test Craft substitute speaker tester, Triplett tube tester model 2413 with 9 pin adaptor, Superior instrument Co. sig. tracer. All in good cond. No reasonable offers refused. Larson's Radio Service, 1012 W. Second St., Rock Falls, Ill.

WANTED — Small screen TV in good cond., 7" Motorola, etc. Will pay $25. Ship COD including freight. Jim English, North 1504 Monroe, Spokane, Wash.

WANTED — National NC-2-40-D receiver in operating cond. Ernest S. Fargo, 3640 Northcliffe Rd., University Hts. 18, Ohio.

FOR SALE — DeForest's Training Radio and TV home study course, A-1 cond., used only once, $15. Buddy Laporte, 48 Allard Blvd., New Orleans 19, La.

WANTED — Wide angle lens for Cine-Kodak 16 mm. movie camera, mount type M. Will pay cash or trade 5" Heath scope or f2.8 35 mm. camera. Mr. S. Wellenc, 256 12th Ave., North Tonawanda, N. Y.

WANTED — Instructograph, state cond. and price. Jack Nelson, 915 Sherman St., Schenectady 3, N. Y.

TRADE OR SELL — Precision E-200C sig. gen. in A-1 cond., for Heathkit scope model 0-9 or equivalent, or best cash offer. N. B. Wynnick, 192 Prospect St., Ansonia, Conn.

SWAP — 7" Admiral TV (will take UHF strips) in good cond., for test equip. J. T. Self, Box 8151, Asheville, N. C.

FOR SALE — Riders manuals 1 to 13 and inc. 15, perf. cond., $70 FOB. Walt Kalem, 12116 Lumpkin, Detroit 12, Mich.

WANTED — Simpson model 480 or 479 scope or sig. gen. State price and cond., or will trade TV sets, 7", 10", 12", 16". Troch's, 290 Main St., Spotswood, N. J.

WANTED — PE103's with or without bases, 500 Ma. swing choke, 813's. Trade or sell dynamotor 12 v. to 440 v. 220 Ma., $10; BC-696 partly modified, $15; l. n. Heathkit scope 0-7, low-cap. probe and spare CRT, $40. Bill Gettman, Norfolk, Neb.

WANTED — Rek-O-Kut model M-5 S, Master-Pro 16" overhead recording mechanism for standard and microgroove recording. L. J. Schnedorf, 610 Monroe Ave., River Forest, Ill.

FOR SALE — Tape recorders: Pentron 9-3C, $120, Brush Soundmirror BK455-P, $205, exc. cond., factory guarantee; unused 1953 Ford custom radio, $55. R. G. Streeter, 15 Hillside Ave., Summit, N. J.

FOR SALE — Pickering 230H preamp with tubes, and 132E record compensator, $30; Collins FM-11 FM-tuner, $45; Sun CR-10 amp. and pre-amp., $50. All exc., satisfaction guaranteed. All FOB. Marilyn Phillips, 418 Gregory, Rockford, Ill.

WANTED — Rider TV manuals. State price and cond. Ace TV, 5341 Cordelia Ave., Baltimore 15, Md.

SWAP — Astatic AT-1 TV booster; watchmaker's staking tool set; Bulova watch repair manual, and tools, all l. n. Can use RME DB-23 preselector and a Bud FCC-90 freq. calibrator. W1YVE, 17 Wolcott St., Malden, Mass.

WANTED — Setchell Carlson model 591 portable range receiver, 200 Kc to 400 Kc. (new quality), state price and shipping terms. William T. Neat, 1137½ W. Lawrence Ave., Springfield, Ill.

SWAP — Type 285 1.6 ratio amplifying transformer in orig. box, for what have you? William A. Borras, 438 Laroussini St., Westwego, La.

WANTED — 7", 10", 12" TV sets in good cond. Reasonable. White's Radio Service, 3642 Elon St., Shreveport, La.

SWAP — 8 mm. Univex camera with f2.5 lens, projector in good cond., including carrying cases, for good comm. rcvr. and instructions on amateur gear for my son. Ray Roy, GE Co., Boston 1, Mass.

SELL OR TRADE — U.S. TV projection system, complete, with 5TP4 pix tube and Bausch & Lomb lens, all chassis, receiver section tunes FM-AM-SW-TV-phono, 12" speaker; 7" Motorola TV table model, A-1; RME preselector, DB-20, very good cond. Robert W. Peters, Lincoln Way, W., Ext., Massillon, Ohio.

FOR SALE — 1950-51 Audio Engineering, 5 years prewar Break In; prewar Radio News, Electronics, Radio and some QSTs from 1920 to 1940. Comet Pro receiver, all coils. Murray J. Douglas, 1401 Amador St., Concord, Calif.

FOR SALE — Riders radio manuals, 6 to 14, $45 FOB. E. McGee, 41 Birch St., Worcester 3, Mass.

FOR SALE — Jackson test oscillator 640, $10; radio-phono-disc recorder (portable 2 speeds), $35. Marvin Shapiro, 1240 Sherman Ave., 1-A, Bronx 56, N. Y.

FOR SALE — Like new Hallicrafters S-40-B receiver, $70. R. E. Johnson, 3 Washington Pl., Cranford, N. J.

WANTED — Back issues of Radio & Television Maintenance magazine. Sam Axelrod, 66 Lewis Ave., Brooklyn 6, N. Y.

FOR SALE — Shure 710 crystal mike Astatic FLC pick up with diamond stylus 78 RPM; Clarkstan 213 pick up arm, needle gauge. J. Holloway, 1421 Arch St., Philadelphia 2, Pa.

WANTED — Model live steam locomotive, any cond. Cash or trade radio equip. Theodore Nadeje, 5101-AA 39th Ave., Sunnyside 4, N. Y.

SELL OR TRADE — Good used Bogan TV booster; TV tuner; 100 copies of radio magazines. G. N. Manning, 205 West Walnut Ave., Dalton, Ga.

FOR SALE — "Party Line" Magneto telephones, in good working order, $15 ea. or $25 a pair. Magneto separate, $8 ea. Trade pair for good 10" or 12" TV. H. Breed, Box 1025, Birmingham, Ala.

WANTED — Riders TV vols. 1, 2, 5, 10, 11, 12 and Radio vol. 22; late model tube tester with tube life and noise test features; PA system. Will pay shipping and cash, give details. Julius Pessecoy, 53 - 05 64th St., Maspeth, L. I., N. Y.

SELL OR TRADE — Finney all-channel TV antenna, model 400, $35; Supreme tube tester, model 503 in good cond., $20. Want recorder or what have you? Alex Poch, Box 174, Dillonvale, Ohio.

FOR SALE — Monitor radio 118-149 Mc., used less than 8 hrs., $40. H. F. Riley, 143 Mt. Pleasant St., New Bedford, Mass.

FOR SALE — Cascamatic BB-2 TV booster, l. n., $12.50 plus postage. James. E. Conaway III, 1310 Purdy Ave., Moundsville, W. Va.

FOR SALE — Regency RC-600 converters, l. n., $29 each. Bud's Radio and Television Service, 5912 Hampton Ave., St. Louis, Mo.

WANTED — Long-wave receiver, 15-600 Kc., with 115 v. AC 60-cycle power supply, in good cond. C. J. Sands, 3425 Edgerton Ave., Wantagh, N. Y.

FOR SALE — '48 and '50 Ford custom auto radios and '52 DeSoto 8-tube custom radio. M. T. Durkot, 9991 Albion Rd., North, Royalton, Ohio.

FOR SALE — Complete, latest model Solovox with 2 speakers, carrying cases, keyboard cover, stand, ext. 10 ft. spkr. cable. Free trial. W. W. Tritchler, Apt. 5, 293 W. 7th St., St. Paul 2, Minn.

WANTED — Pilot "3" or Sentinel 8" TV set in operating cond. State price. Carl Westbery, Hoopeston, Ill.

WANTED — National MB-20 multi-band tank. Cash or swap good 813 Xmtr. tube and pair of new 808 tubes. H. R. Bradford, 2289 - 25 Ave., San Francisco 16, Calif.

FOR SALE — Back issues of Scientific American July 4, 1903 to Dec. 26, 1903; also June 6, 1910 to Dec. 31, 1910. Have Scientific American Supplement of 1911 and 1908. Carl Liquori, 403 Monroe St., Hoboken, N. J.

WANTED — Acrosound TO-300 output transformer. State cond. and price. Have 5" Weston 0-20-200 DC millivolt meter for sale. Denver F. Moffett, 107 Quincy St., Clarksburg, W. Va.

FOR SALE — Radio FM-AM-SW, PP 6V6 output, phono input $55; Heath scope OC8 new wired, tested, $75; Supreme analyzer model 333, $25; Sonar VFX60, $50. A. Dayes, 29 Charles St., Merrick, L. I., N. Y.

SELL OR TRADE — Hallicrafter S-76 portable comm. receiver, .54 - 30 Mc., AC or battery, l. n., $75; Webster-Chicago automatic record-changer, 33⅓ RPM, with metal base pan., exc. cond., $18. S. Magasin, 125 N. Sycamore Ave., Los Angeles 36, Calif.

FOR SALE — RCA: 68B beat freq. osc., $75, 155A scope, $30; Hickok: 288X sig. gen., $80, 195 scope, $60; General Radio: 724A wavemeter, $90, 731B mod. monitor, $55. Poplar Radio. 752 Poplar Grove St., Baltimore 16, Md.

SELL OR TRADE — Pair Walkie-Talkies, No. 222; 2,000 feet 16 mm. silent film; Zenith 3-way portable; ATR inverter; etc. E. G. Bartlett, Atlanta, Mo.

WANTED — NRI service manual vol. 1 and 2; Sams TV course. State cond. and price. Jerry M. Pelton, Box 185, Rock Falls, Ill.

WANTED — Type FCC90 bud frequency calibrator with tube and Xtal, also Millen freq. shifter 90700. Will pay cash. C. E. Hinchley, 29 Rhinecliff St., Arlington 74, Mass.

TRADE — Automatic record player in good cond., usable on any radio with plug-in jack. Want 35 mm. camera, or fishing tackle, or what have you? Earnest P. Couch, Jr., 1805 College St., Decatur, Ala.

FOR SALE — Riders TV manuals, 1 thru 8, $75, will not split; RCA sweep gen., WR-59B and RCA scope WO-57A. Both $200, l. n. Vincent Iavarone, 1218 Leland Ave., Bronx 72, N. Y.

WANTED — Hallicrafters S-38 in good cond. at low price, consider trading BC-348 converted to AC. John Gleason, 305 Domaris Ave., Lake Wales, Fla.

FOR SALE — Riders TV manuals 2 thru 9 incl., good cond., $75. Harry Handler, 1161 Elder Ave., Bronx, N. Y.

WANTED — Coils for SW-3 National receiver NO-30-10 meter 31A 20 meter, 33A 40 meter, any one of above, also small VFO 40-80 meter output. Don Guptill, 17 Park St. Ct., Medford, Mass.

WANTED — Schematic for Karpsh (radio of Austrian make) with the following tube line-up: EK2, EF9, EL3, EB3, EZ4, and EM1. State terms. Alexander M. Remer, 517 W. 161st St., New York 32, N. Y.

FOR SALE — Two l. n. Bliley 100 Kc. and 1,000 Kc. crystals, recommended circuit, $5 ea., or two for $9; Millen 829B Hi-Fi amp. for 2-6-10 meter operation, orig. carton, set of 10 meter coils, $20 plus postage. Herb Goldstein, 936 S. 20th St., Newark 8, N. J.

FOR SALE — 4 l. n. .002 Mfd. C-D transmitting mica cond. type 9-2500 v. DC working, $4 postpaid. L. Cohen, 151 - 09 34th Ave., Flushing, N. Y.

WANTED — Cash or radio receiver SW, perf. cond., for camera, 620 roll film, Kodak Vollenda f4.5 lens, Compur shutter, and Kodak Retina f3.5 35 mm. Compur rapid shutter to 1/500th second, exc. cond. M. D. Weissman, 1537 Unadilla St., Schenectady, N. Y.

WANTED — RF coil for Electronic Corp. of America 7-tube 3-way portable model 2001, part no. L2 A1095. Seymour Cohen, 10 S. 2nd St., Mount Vernon, N. Y.

SELL — BC221 freq. meter; Hallicrafter SX25; BC375E complete; RCA Marine comm. rcvr., AR 8507-70-515 Kc.; Command set, complete with all accessories; Mark II transceiver, complete. M. K. Hardgrove, Friar's Lane, Springdale, Conn.

WANTED — Power supply used with Admiral TV set, model 4H-116-S, Chassis No. 30 B1, 10" tube. William Nelson, c-o Voorhees Walker Foley & Smith, 101 Park Ave., New York 17, N. Y.

FOR SALE — Complete radio-TV training school course, 100 lesson texts, 10 radio training kit lessons (no kit parts), l. n., $25. T. C. Coughlin, 441 - 42nd St., Brooklyn 32, N. Y.

WANTED — Heathkit VTVM, V7 or later; home study course speaking Spanish with records; inexpensive all-wave radio transformer operated with tuned RF stage. R. E. Cauble, 114 - 44 226th St., Cambria Heights 11, N. Y.

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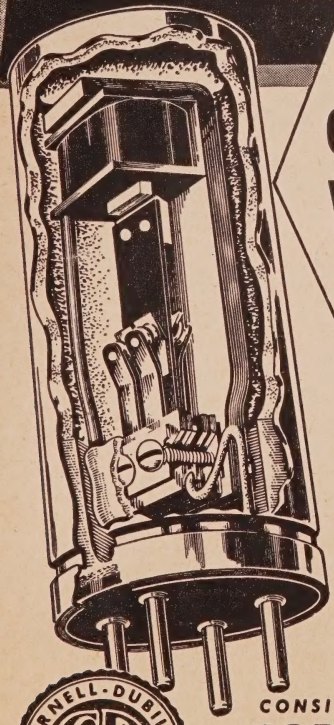

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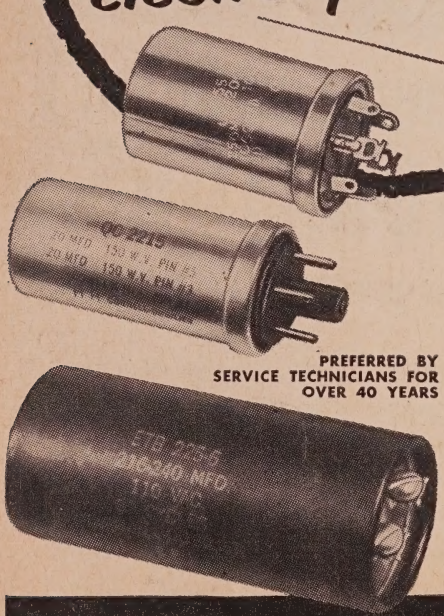

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